

Unit 41: Networking Principles

Unit code: J/601/3250
QCF Level 3: BTEC Specialist
Credit value: 10
Guided learning hours: 75

Aim and purpose

This unit provides the skills and understanding required to design, install and maintain networked systems. It covers topologies, the OSI model and TCP/IP.

Unit introduction

Networking skills are particularly valued in the IT industry and this unit provides a solid foundation for learners to gain knowledge and understanding of networking models.

Learners will be introduced to the physical and logical topologies of networks and understand the purpose and function of network hardware, software and interconnection devices.

The unit introduces learners to the OSI model and the TCP/IP protocol suite and their features, functions and standards.

Learning outcomes and assessment criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

On completion of this unit a learner should:

Learning outcomes	Assessment criteria
1 Understand physical and logical topologies and systems	1.1 describe common physical network topologies 1.2 explain the difference between logical and physical network topologies 1.3 describe the network topologies and hardware and software components used to implement common data communication systems <ul style="list-style-type: none"> • identify common • cable types and properties • connector types • wiring standards • wireless standards
2 Understand the Open System Interconnection (OSI) model	2.1 describe the OSI model and how its layers relate to each other 2.2 explain the function of each layer of the OSI model 2.3 describe the key features, protocols and standards of each OSI layer
3 Understand the Internet Protocol Suite (TCP/IP)	3.1 describe the Internet Protocol Suite (TCP/IP) and the function of its four layers 3.2 describe the key features, protocols and standards of each TCP/IP layer 3.3 explain how TCP/IP relates to the OSI model

Unit content

1 Understand physical and logical topologies and systems

Physical topologies: types eg star, bus, ring, mesh, tree; features; standards eg IEEE802 standards for LANs and WANs

Logical topologies: signal topology; logical networks eg Ethernet, LocalTalk, token ring

Network hardware: work station, server, network interface card, interface controller, repeater, passive, active and intelligent hubs, bridge, switch, router, gateway

Network software: network operating system, firewall, virus checker, email

Interconnection devices: cable types eg Cat 5 and RJ45, Cat 5e and RJ45, Cat 6 and RJ45, thin co-axial and BNC connector, thick co-axial and AUI transducer with patch cable, fibre optic cables and connectors; IEEE standards; wireless LANs eg 802.11, infrared, Bluetooth, 3G

Common data communication systems: LANs, WANs, wired, wireless

2 Understand the Open System Interconnection (OSI) model

OSI model: protocol ie 7 layers (Physical, Data Link, Network, Transport, Session, Presentation, Application); relationships, functions, features, standards eg ISO, ITU-T

3 Understand the Internet Protocol Suite (TCP/IP)

TCP/IP: transmission control protocol; internet protocol; layers (data flow or network access, internet, transport, application); functions, features, standards; relationship with OSI model

Essential guidance for tutors

Delivery

This unit can be delivered in the order of the learning outcomes. Learners will need as much practical work as possible to bring the theory to life. The use of in-centre computer labs, talks and demonstrations by the centre technicians, and visits to installations will all help with the teaching and learning.

Learning outcome 1 starts with the basics of network hardware and software, interconnection devices and topologies. Quite a lot of time should be spent on getting learners familiar with the terminology and the hardware. Building simple networks for themselves will reinforce learning. Exposure to both wired and wireless networks should be included.

Learning outcomes 2 and 3 deal with the OSI model and the TCP/IP protocol. Learners can research these, perhaps in groups, and pool their findings. Discussions with technicians can help learners understand how these protocols work in practice and why each is used and when. Gapped handouts can be a useful tool for recording the relationship between the two.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments. The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
<p>Introduction to the unit</p> <p><i>Physical and logical topologies</i></p> <ul style="list-style-type: none"> • Network topologies – illustrations, research, demonstrations • Network hardware – practical work, research, creating posters • Network software – technician talk, research, posters • Interconnection devices – practical work, research, demonstrations • Wired, wireless systems – research.

Topic and suggested assignments/activities and/assessment
Assignment 1 - Network Topologies Assignment 2 - Interconnection Devices
<i>OSI model</i> <ul style="list-style-type: none"> • 7 layers – tutor led, research, technician talk • Features and standards – research, notes, gapped handouts.
<i>TCP/IP</i> <ul style="list-style-type: none"> • TCP and IP – distinction, tutor led, technician talk • Layers – tutor led, research • Relationship with OSI – research, discussion, gapped handouts.
Assignment 3 - Models and Protocols

Assessment

It is suggested that this unit is assessed using the three assignments summarised in the *Programme of suggested assignments* table.

Learning outcome 1 has four assessment criteria and can be assessed after the teaching of that outcome.

A suitable scenario might be that the learner has recently been employed as a trainee network technician and has been asked to demonstrate their understanding of topologies and components. Evidence can be presented as a leaflet or in any other suitable format. Learners are expected to be able to 'describe' for 1.1 and 1.3. The unit content provides a list of the expected range of coverage. Topologies can be described using annotated diagrams. The diagrams for 1.3 may also cover some of the requirement for 1.1.

1.2 requires an explanation of the difference between logical and physical topologies. This should be more than just a description of both topologies.

For 1.4, learners may be observed identifying physical examples of the cables and connectors and a witness statement prepared as evidence. If learners are undertaking networking tasks, this evidence may be collected then. Alternatively, this could be presented visually as a poster identifying the different cable types and connectors with notes about wiring and wireless standards.

For learning outcome 2 (2.1–2.3) and learning outcome 3 (3.1–3.3), learners (in their role as trainee technicians) can be asked to prepare a presentation on the OSI model and the TCP/IP protocol.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the assessment criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
1.1, 1.2, 1.3	Network topologies	You are to show your understanding of topologies by creating an explanatory leaflet.	Leaflet – illustrated.
1.4	Interconnection devices	Identify cables and connectors.	Witness statement.
2.1, 2.2, 2.3 3.1, 3.2, 3.3	Models and protocols	You are to give a presentation on the OSI model and the TCP/IP protocol.	Presentation.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC in IT sector suite. This unit has particular links with:

Level 1	Level 2	Level 3
	An Introduction to Communication Technologies	Networking Principles
	Setting up an IT Network	Communication Technologies
		Computer Networks
		Core Network Techniques
		Managing Networks

This unit maps to some of the underpinning knowledge from the following areas of competence in the Level 3 National Occupational Standards for IT (ProCom):

- 4.7 Systems Design
- 5.1 Systems Development
- 5.3 IT/Technology Solution Testing.

Essential resources

Learners will require access to computer equipment to enable them to gain a practical awareness and enable them to apply their knowledge and understanding in a practical situation.

Employer engagement and vocational contexts

The use of vocational context is essential in the delivery and assessment of this unit. There is a range of organisations that may be able help centres to engage and involve local employers in the delivery of this unit, for example:

- Learning and Skills Network – www.vocationallearning.org.uk
- Local, regional business links – www.businesslink.gov.uk
- National Education and Business Partnership Network – www.nebpn.org
- Network for Science, Technology, Engineering and Maths Network Ambassadors Scheme – www.stemnet.org.uk
- Work-based learning guidance – www.aimhighersw.ac.uk/wbl.htm
- Work experience/workplace learning frameworks – Centre for Education and Industry (CEI University of Warwick) – www.warwick.ac.uk/wie/cei

Indicative reading for learners

Textbooks

Dodd A Z – *The Essential Guide to Telecommunications, 4th edition* (Prentice Hall, 2005)
ISBN-10 0131487256, ISBN-13 978-0131487253

Hallberg B – *Networking: A Beginner's Guide, 5th Edition* (Osborne/McGraw-Hill US, 2009)
ISBN-10 0071633553, ISBN-13 978-0071633550

Lowe D – *Networking All-in-One Desk Reference for Dummies, 3rd Edition*
(John Wiley & Sons, 2008) ISBN-10 0470179155, ISBN-13 978-0470179154

Schiller J – *Mobile Communications, 2nd Edition* (Addison Wesley, 2003)
ISBN-10 0321123816, ISBN-13 978-0321123817

Websites

www.howstuffworks.com

www.webopedia.com

Functional Skills – Level 2

Skill	When learners are ...
ICT - Finding and selecting information	
Use appropriate search techniques to locate and select relevant information	describing the OSI model and TCP/IP suite
Select information from a variety of sources to meet requirements of a complex task	identifying common cables and connectors
ICT - Developing, presenting and communicating information	
Combine and present information in ways that are fit for purpose and audience	describing the OSI model and TCP/IP suite explaining the relationship between the OSI model and TCP/IP suite.
Evaluate the selection, use and effectiveness of ICT tools and facilities used to present information	